Nokia Customer Care
RH-21 Series Transceivers

Troubleshooting

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Troubleshooting

The first thing to do when a problem is encountered is to carry out a thorough visual check of the module. Make sure that:

- there are no mechanical damages
- the solder joints are OK

Note: Before changing anything, ALL SUPPLY VOLTAGES AND THE SYSTEM CLOCK / SLEEP CLOCK should be checked.

Baseband Troubleshooting

General testing information

There are three different modes for testing and/or repairing the phone. The mode can be selected with suitable resistors connected to BSI- and BTEMP- lines as illustrated in the following table:

Table 1: Phone operating mode

Mode	BSI- resistor	BTEMP resistor	Remarks
Nor-mal	68k	75k	
Local	560_(<1k_)	Whatever	
Test	> 1k	560_(<1k_)	Recommended for baseband testing. Same as local mode, but making a phone call is possi-ble.

If the corresponding resistors are connected, the MCU software automatically enters into the local or test mode when the supply voltage is connected to the phone.

The power can be switched on by:

1 Pressing the power key.

2 Connecting the local/test mode resistors to the BSI/BTEMP lines and connecting the battery voltage to the phone.

3 Connecting a charger.

4 Using the phone's internal functions (real-time clock alarm).

In the local and test mode, the baseband can be controlled through MBUS or FBUS (FBUS is recommended) connections using Phoenix service software.

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Troubleshooting

Note: Most of the baseband repair actions require removing the baseband shield. The shield must not be removed unless separately authorized by the program.

Note: The phone's ESN has to re-written to the UEM, if the UEM is replaced. This can be done only in Central Service.

The baseband troubleshooting instructions include the following topics:

1 Power up

2 Flash programming

3 Audio

- Earpiece
- Microphone

4 Charging

5 Accessory detection

6 Sleep clock

7 User interface

- Display
- Lights
- MIDI
- Vibra
- Keyboard

Power-up faults

Power-up sequence

1 The UEM acts as a HW master during start up

- Vbatt limits: 2.1V for internal state machine, 3V triggering whole startup
- Regulator sequencing
- HW "core" regulators "on": Vio, Vcore, VR3, Vflash1
- These regulators supply the processors, memory chip interfaces and clock source in RF
- Reset releasing delay

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- Supply voltages stabilize to their UEM HW default values
- RFCLK grows to full swing
- The core is ready to run but waiting for the PURX release
- Reset releasing
- The UPP releases the SLEEPX up to the "non sleep" state to prevent the UEM switching the regulators "OFF"

2 MCU starts running the Bootstrap Code

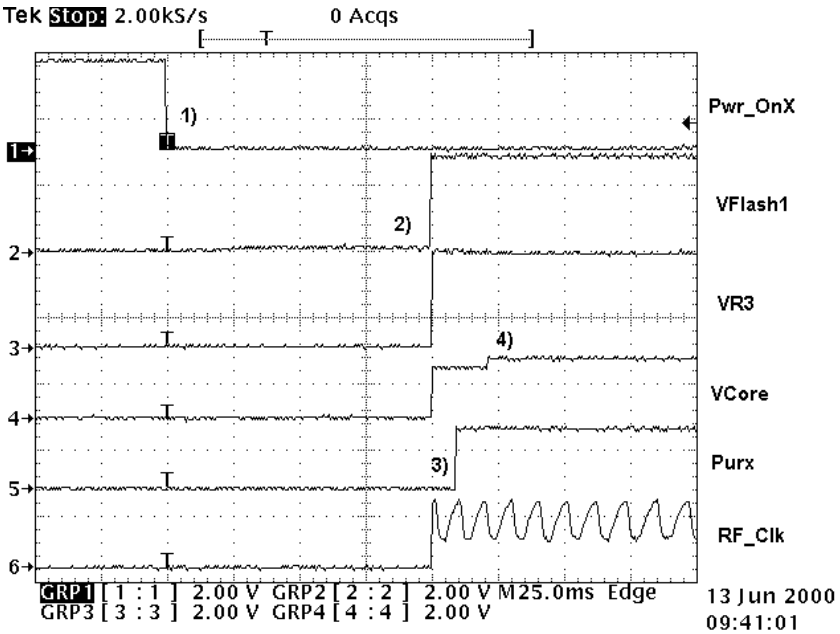
- written in stone/ UPP internal ROM
- the program checks if there is any reason for the FDL mode (Flash Down Load)
- If there is an executable code in FLASH and there is no reason for FDL, the MCU starts running the MCU program from FLASH

3 MCU runs the FLASH MCU code

- the phone initialization, user interfaces, internal blocks, etc.
- Core regulator voltage setting for required DSP speed
- Initializes the DSP and concerning HW
- Releases DSP reset -> DSP starts running

Note: In the following figure, the RF_Clk frequency appears to be lower than 19.44MHz because of a too low oscilloscope sampling frequency (2kS/s).

Figure 1: Power-up sequence



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1 Power key pressed

- After 20ms, UEM enters RESET MODE if VBAT>Vmstr+
- VFLASH1, Vana, Vcore, Vio, and VR3 goes high
- VCTCXO enabled by VR3 -> RFClk 19.44 MHz running

2 Purx released

- Purx released by UEM, UEMINT goes high for 100 ms, SleepX goes high, and SleepClk (32 KHz) starts running.

3 Software running

- Default value for Vcore is 1.5 volts and, if software is running, Vcore will rise to 1.8 volts
- Cbus (1.08MHz) and Dbus clocks start running

Phone does not start up normally or does not stay on

Note: In the case of power-up faults, it is not possible to force the phone on by disabling the watchdog. Instead, measurements should be taken immediately when the power key is pressed or when the battery voltage is connected to the phone (local / test mode).

The easiest way to check if the software is running when the phone takes an abnormal amount of current is to measure the *cbusclk* and *Vcore*.

The Dbus clock (programmable 9.72MHz) is not automatically visible in the test and local modes.

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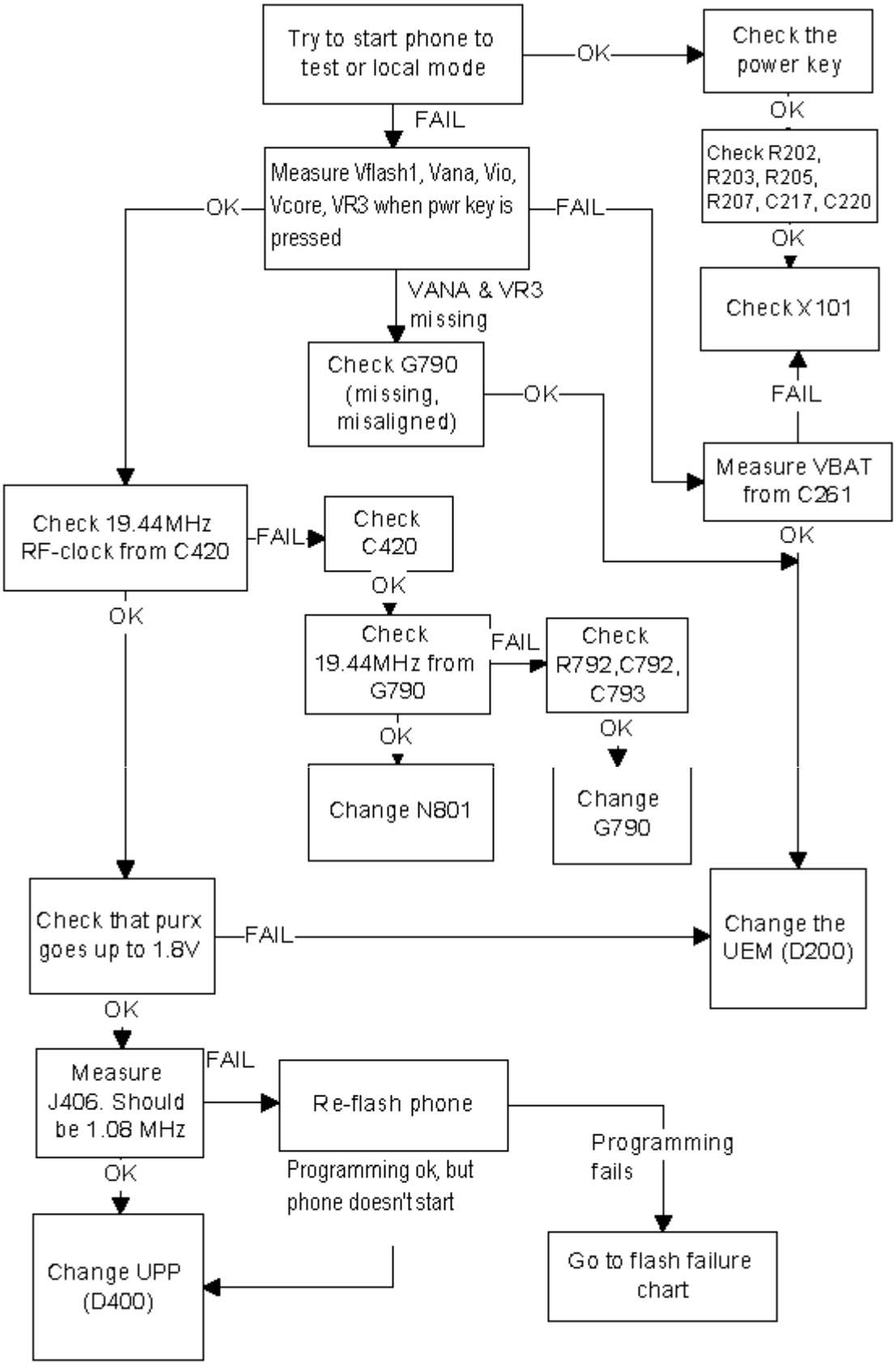
Figure 2: Fault tree, phone does not power up



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Flash Programming does not work

Flash programming procedure

1 The phone communicates with the prommer via the production test pattern, using the following signals:

- FBUSTX (serial data to phone)
- FBUSRX (serial data from phone)
- MBUS (serial clock for FBUSRX)
- VPP (External flashing voltage for speed up flashing)
- The BSI line is also used when initializing flashing (battery connec- tor)

2 When the phone is powered (VBAT>3V), the MBUS and FBUSTX lines are pulled up internally by the phone.

3 The prommer sends a command to the UEM, using FBUSRX, to enter the Flash-mode. During the sending of this command, the prommer keeps the BSI line high and MBUS is used as a serial clock.

4 When the Flash-mode command is acknowledged, UEM enters the Flash-mode and releases reset (PURX) to MCU.

5 After reset is released, UPP checks if there is a request for the Bootstrap code (that resides in the UPP ROM).

6 The request for Bootstrap is the MBUS pulled down by the prommer (if the bootstrap is not requested, the bootstrap code jumps to FLASH SW).

7 If the Bootstrap code is requested, UPP enters the Flash-mode and sets FbusTX to '0' as an acknowledgement to the prommer. This is an indication that UPP can run, at least, the fixed Bootstrap code – although it is not able to run the FLASH code. UPP then sends an UPP-ID to the prommer via the FBUSTX line.

8 After the prommer has received the UPP-ID, it sends a corresponding Secondary Boot Code to the phone via FBUSRX. The Secondary Boot Code, when run in UPP, requests UPP to send information to the prommer about the flash type and other HW-related parameters about the device to be flashed.

9 The prommer then sends the Algorithm Code corresponding to the HW parameters, and this algorithm, when run in UPP, takes over handling the MCUSW transfer to Flash.

10 12 volts can be supplied to Vpp (by the prommer) to speed up flashing.

11 The FLASH Program includes a package of MCU and DSP software and all default parameters for the phone. The tuning values will be added/rewritten during the

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Flash/Alignment phase.

Flash programming error codes

The various error codes can be seen from the "FPS-8 Flash" in Phoenix.

The underlined text in the following table means that the item under consideration is being used for the first time in the flashing sequence.

Error	Description	Not working properly
C101	"The Phone does not set FbusTx line high after the startup."	Vflash1 VBatt BSI and FbusRX from prommer to UEM. FbusTx from UPP->UEM->Prommer(SA0)
C102	"The Phone does not set FbusTx line low after the line has been high. The Prommer generates this error also when the Phone is not connected to the Prommer."	PURX(also to Safari) VR3 Rfclock(VCTCXO->Safari->UPP) Mbus from Prommer->UEM->UPP(MbusRx)(SA0) FbusTx from UPP->UEM->Prommer(SA1) BSI and FbusRX from prommer to UEM.
C103	"Boot serial line fail."	Mbus from Prommer->UEM->UPP(MbusRx)(SA1) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
C104	"MCU ID message sending failed in the Phone."	FbusTx from UPP->UEM->Prommer
C105	"The Phone has not received Secondary boot codes length bytes correctly."	Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
C106	"The Phone has not received Secondary code bytes correctly."	Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer

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C107	"The Phone MCU can not start Secondary code correctly."	UPP
C586	"The erasing status response from the Phone informs about fail."	Flash
C686	"The programming status response from the Phone informs about fail."	Flash
Cx81	"The Prommer has detected a checksum error in the message, which it has received from the Phone."	FbusTx from UPP->UEM->Prommer
Cx82	"The Prommer has detected a wrong ID byte in the message, which it has received from the Phone."	FbusTx from UPP->UEM->Prommer
A204 Cx83 Cx84 Cx85	"The flash manufacturer and device IDs in the existing Algorithm files do not match with the IDs received from the target phone." "The Prommer has not received Phone acknowledge to the message." "The Phone has generated NAK signal during data block transfer." "Data block handling timeout"	Flash UPP VIO/VANA? Signals between UPP-Flash Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
Cx87	"Wrong MCU ID."	RFClock UPP(Vcore)
Startup for flashing	Required startup for flashing	Vflash1 VBatt

Charging

Note: The charging voltage and current can be checked by connecting the phone to the service software and reading the ad- converter values of the vchar and ichar.

If charging fails when the ACP-9 or the LCH-9 is used, but works with ACP-7, ACP-8, and LCH-8, check that the charge control pin of the system connector is connected to the ground.

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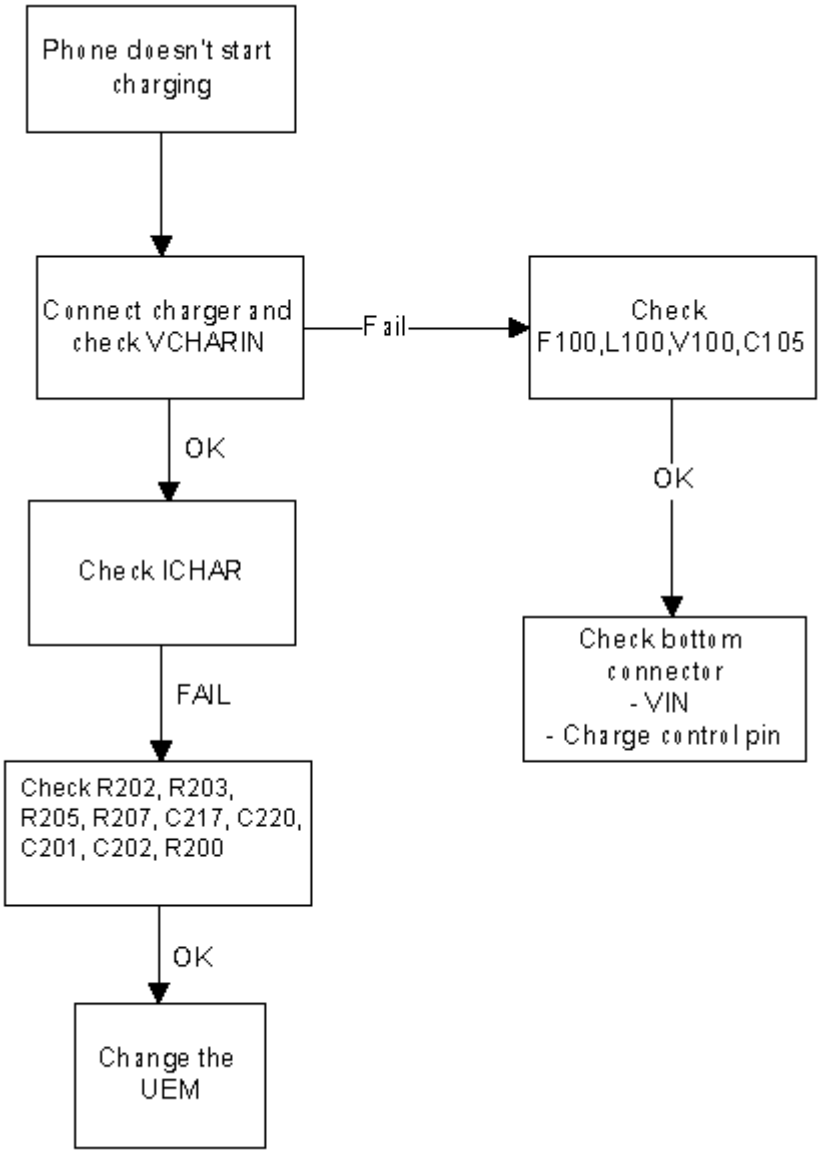
Figure 3: Fault tree, charging



Audio failures

In case of audio failures, there are three possibilities to check the audio lines.

1 Make a phone call against tester and check audios.

2 *If the earpiece/XMIC fails:* Feed a 1Khz signal to the XMIC line and measure the signal from the earpiece line. The Audio test box JBA-8 is needed. The Audio loop (*Audio test/Ext In Hp Out*) must be switched on by the Phoenix service software. This loop will connect audios only through the UEM. In this case, the UPP is not used.

If the internal microphone/XEAR fails: Feed the tone to the microphone and measure the signal from the XEAR line. The Audio test box JBA-8 is needed. The Audio loop (*Audio test/Hp In Ext Out*) must be switched on by the Phoenix service software. This loop will connect audios only through the UEM. In this case, the UPP is not used.

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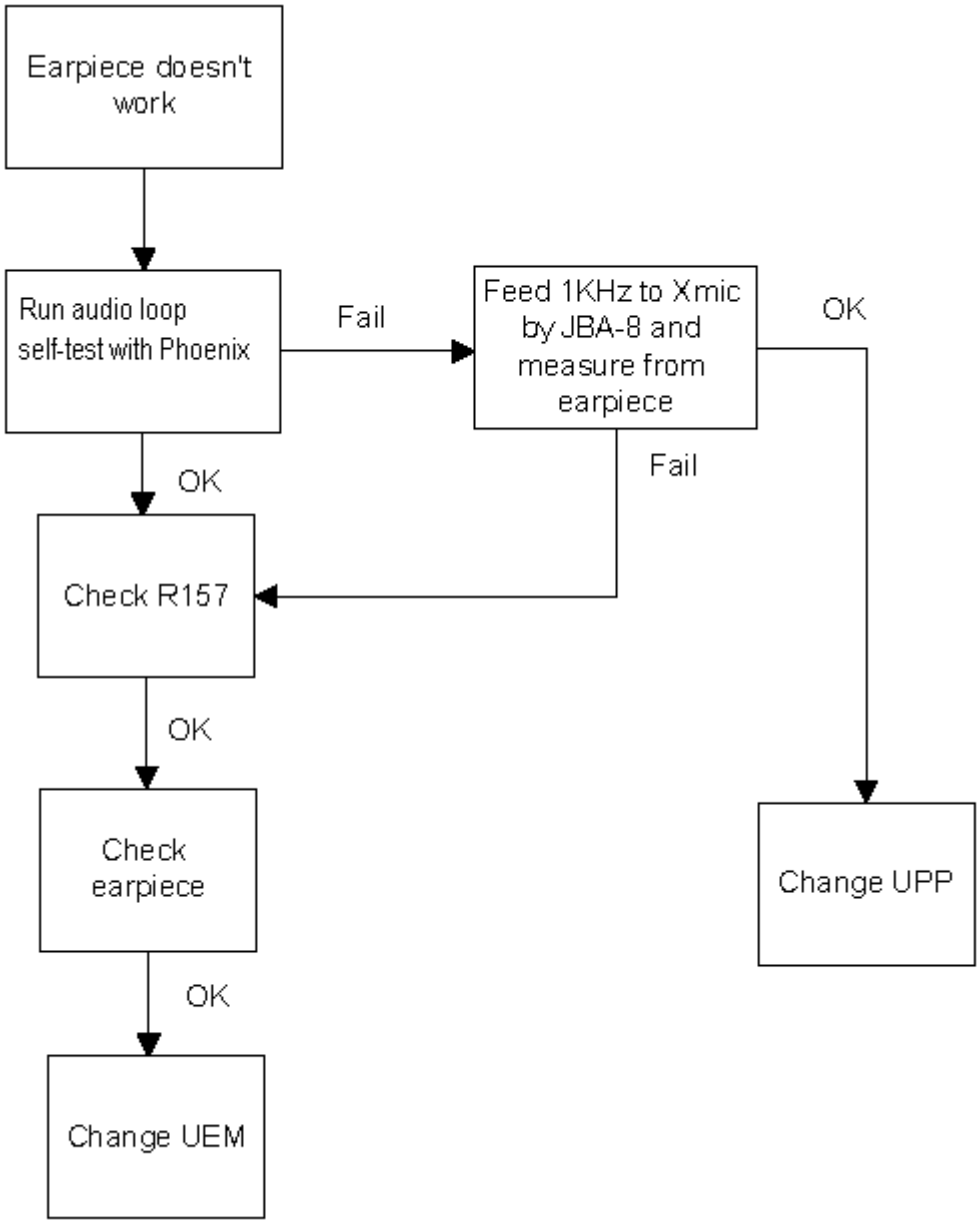
3 Run the audio-loop self-test with Phoenix (*BB Self Tests/ ST_EAR_DATA_LOOP_TEST*). This loop will test the ear-data/mic-data lines between the UPP and the UEM.

Earpiece or external microphone line does not work

Figure 4: Fault tree, earpiece failure



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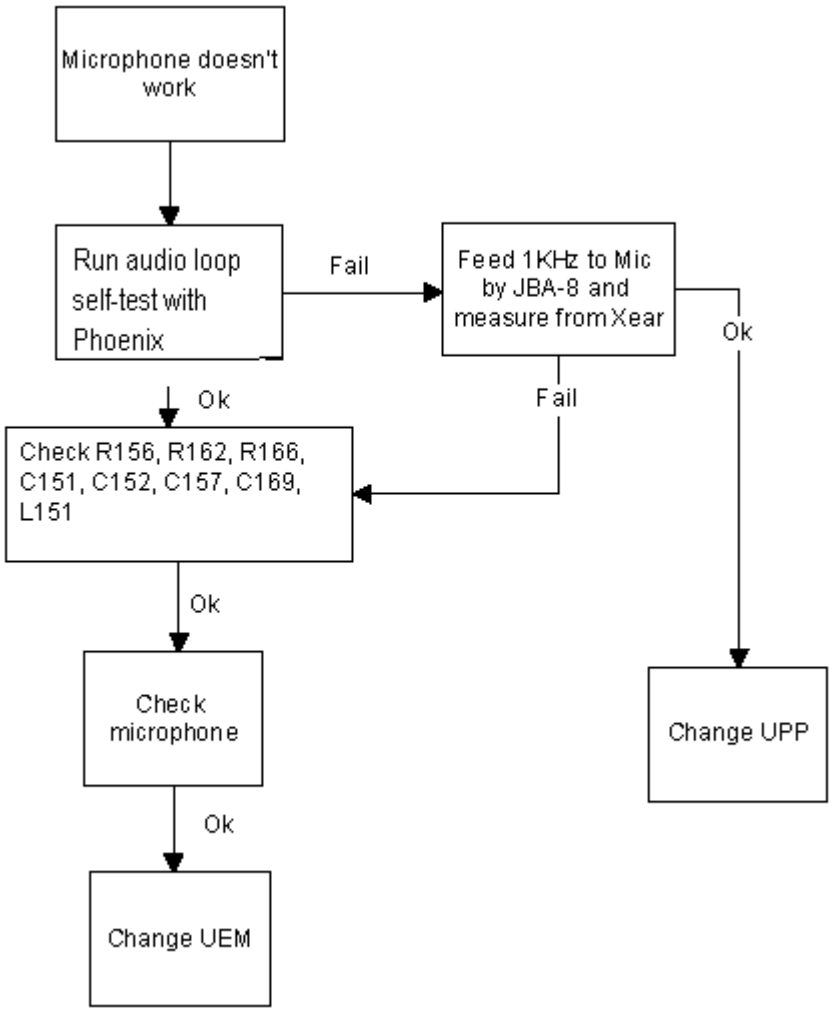
Microphone or XEAR line does not work

Figure 5: Fault tree, microphone failure



Accessory detection

1 Start the phone in the normal mode when checking for accessory detection.

2 The Ad-converter value of the hookint-line can be checked with the Xmic switch on an MJ-8 test jig. Changes normally from high to low when no accessory is connected.

3 When the headset HDC-5 is connected, the hookint-value should be between 600 and 800.

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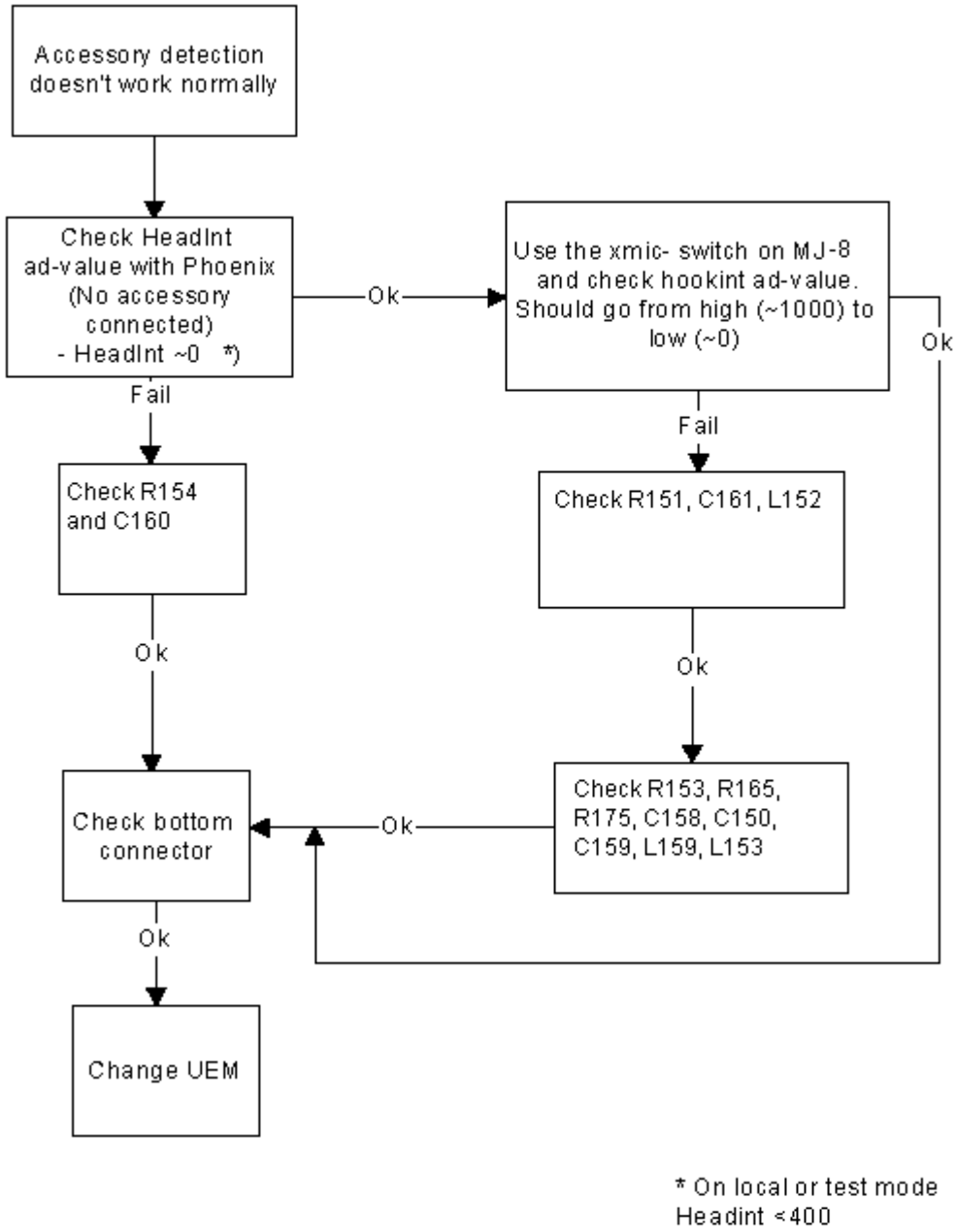
Figure 6: Fault tree, accessory detection


Accessory detection doesn't work normally
Check HeadInt ad-value with Phoenix (No accessory connected) - HeadInt ~0 *)
Ok
Use the xmic- switch on MJ-8 and check hookint ad-value. Should go from high (~1000) to low (~0)
Ok
Fail
Fail
Check R154 and C160
Check R151, C161, L152
Ok
Ok
Check bottom connector
Ok
Check R153, R165, R175, C158, C150, C159, L159, L153
Ok
Change UEM
* On local or test mode
Headint <400

Sleep Clock

Missing/nonfunctional sleep clock causes

- Entering sleep mode fails (higher current consumption -> shorter standby time)
- Baseband self-tests cannot be run
- Phone clock (on display) does not function properly

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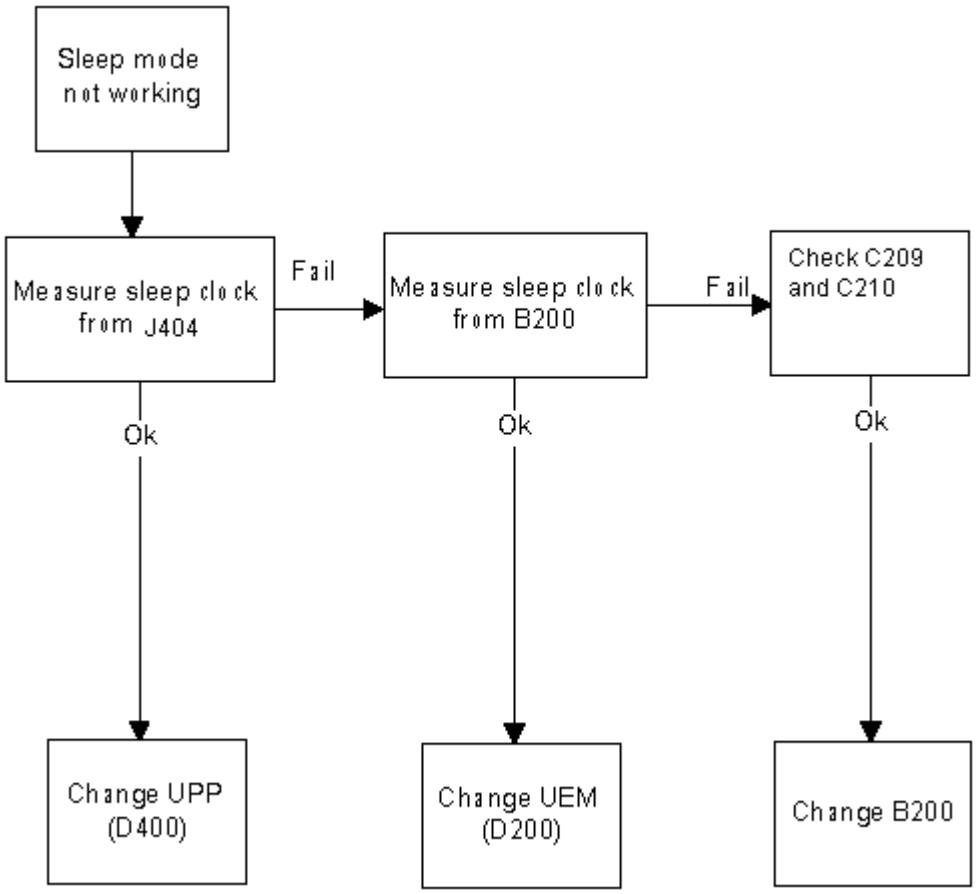
Figure 7: Fault tree, sleep clock



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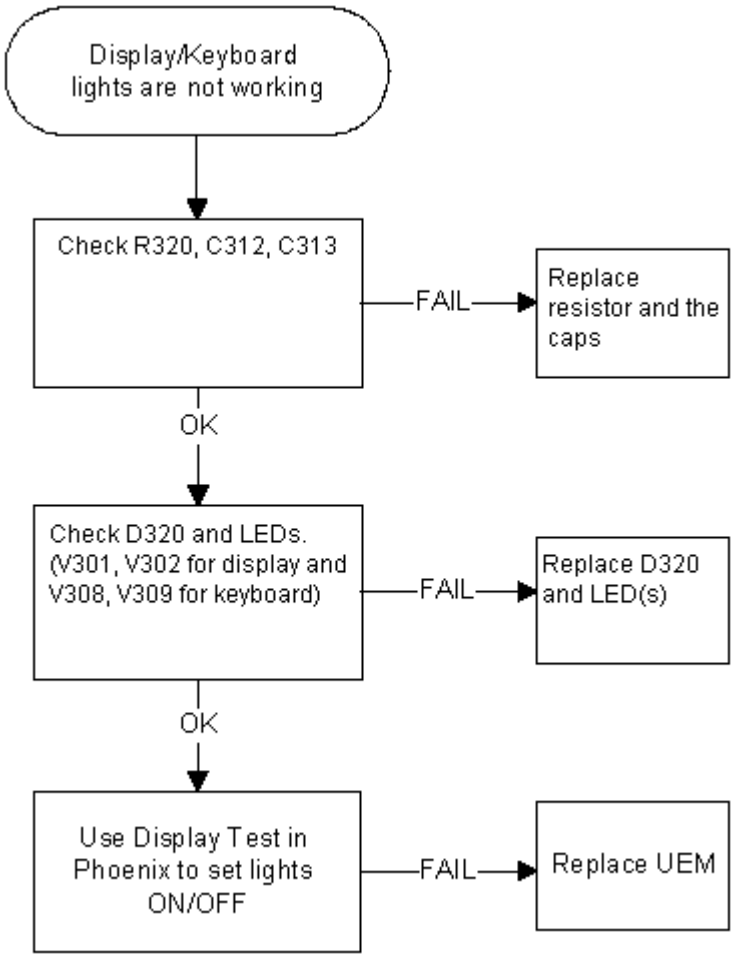
User Interface

Display/Keyboard lights do not work

Figure 8: Fault tree, Display/Keyboard lights



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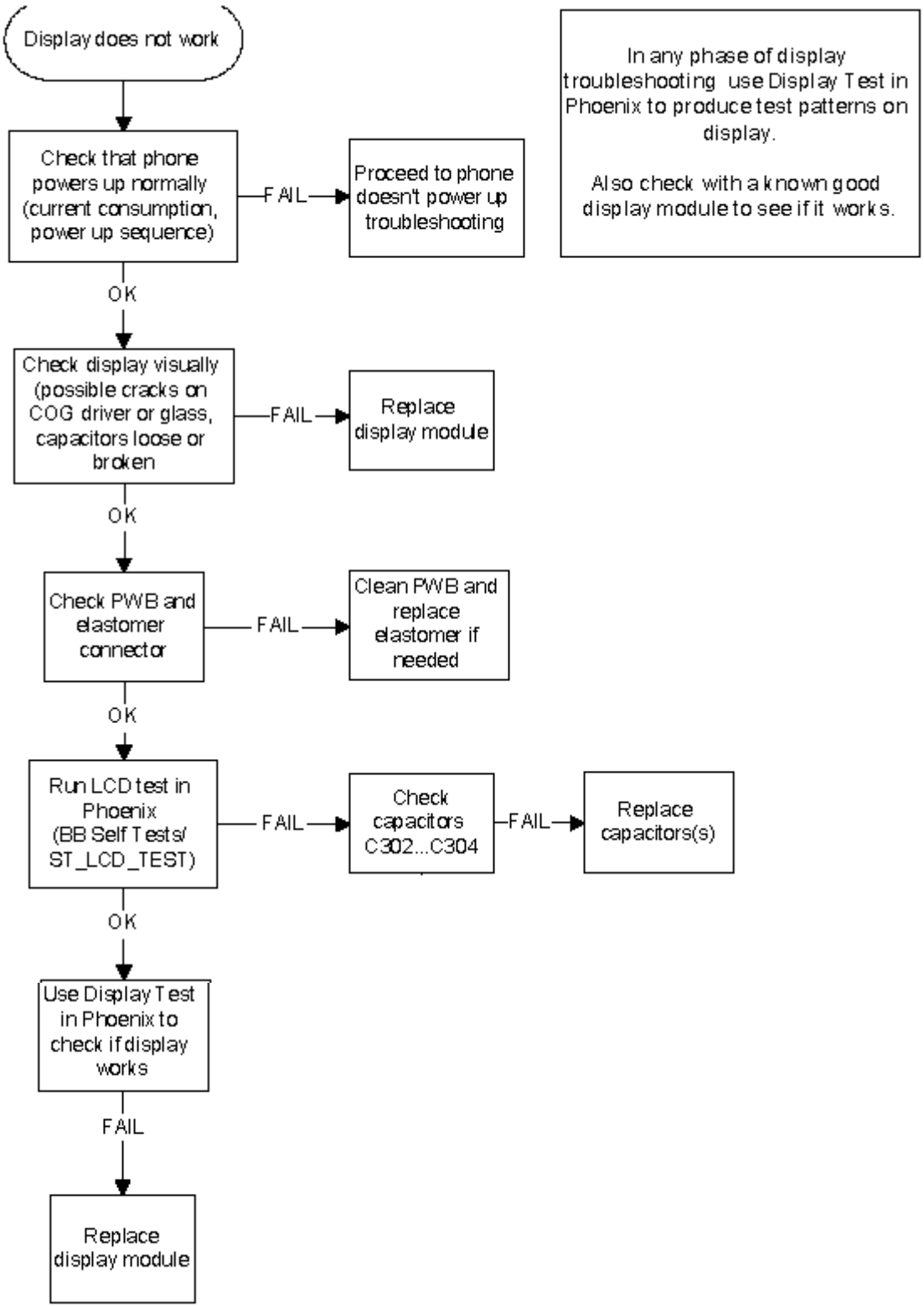
Display does not work

Figure 9: Fault tree, Display does not work


Display does not work
Check that phone powers up normally (current consumption, power up sequence)
FAIL
Proceed to phone doesn't power up troubleshooting
In any phase of display troubleshooting use Display Test in Phoenix to produce test patterns on display.
Also check with a known good display module to see if it works.
OK
Check display visually (possible cracks on COG driver or glass, capacitors loose or broken
FAIL
Replace display module
OK
Check PWB and elastomer connector
FAIL
Clean PWB and replace elastomer if needed
OK
Run LCD test in Phoenix (BB Self Tests/ ST_LCD_TEST)
FAIL
Check capacitors C302...C304
FAIL
Replace capacitors(s)
OK
Use Display Test in Phoenix to check if display works
FAIL
Replace display module

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MIDI does not work

Check speaker B180 and the following components: N180, R100, R181, R182, R183, R184, C183, C180, C184, C181, C182, C179, L180, and L181

- No sound: Try using a known good SALT speaker instead. If there is still no sound, change the UEM (D200)
- Weak sound: Use the Audio test in Phoenix to set the SALT speaker parameters (frequency, strength). If it does not affect the sound level, change the SALT speaker.

Vibra does not work

Check spring connectors and C307 and C308.

- No vibration: Try using a known good vibra instead. If there is still no vibration, change the UEM (D200)
- Weak vibration: Use the Vibra test in Phoenix to set the vibra's parameters (frequency, duty cycle). If it does not affect the magnitude of the vibration, change the vibra.

Keyboard does not work

Check that there is no dirt between the dome sheet and the PWB. If the keyboard still does not operate normally, try to use the Keyboard test in Phoenix to see if the pressed key is identified. If it is not identified, change the UPP (D400).

Receiver Troubleshooting

General Instructions for RX troubleshooting

Start the Phoenix software and use it to start the required RX mode of the mobile phone. The troubleshooting flowchart is divided into three steps: (1) general checking, (2) local checking, and (3) RX-chain checking. Always use an RF cable connected from an external RF connector to the analyzer via (RF power) attenuator. This is important to protect the analyzer against excessive RF power and to prevent leakage of undesired RF power into the cellular frequencies.

1 Start the Phoenix software and select the TX mode under *Testing* (AMPS, DAMPS, or TDMA1900).

2 It is useful to select the mid channel (383 for AMPS/DAMPS or 1000 for TDMA1900) and the power level 2.

Note: Before changing ASICs or filters, all solderings and missing components must be checked visually. After any possible component changes, the phone must be tuned with the Phoenix autotune SW.

Path of the received signal

Block level description of the receiver:

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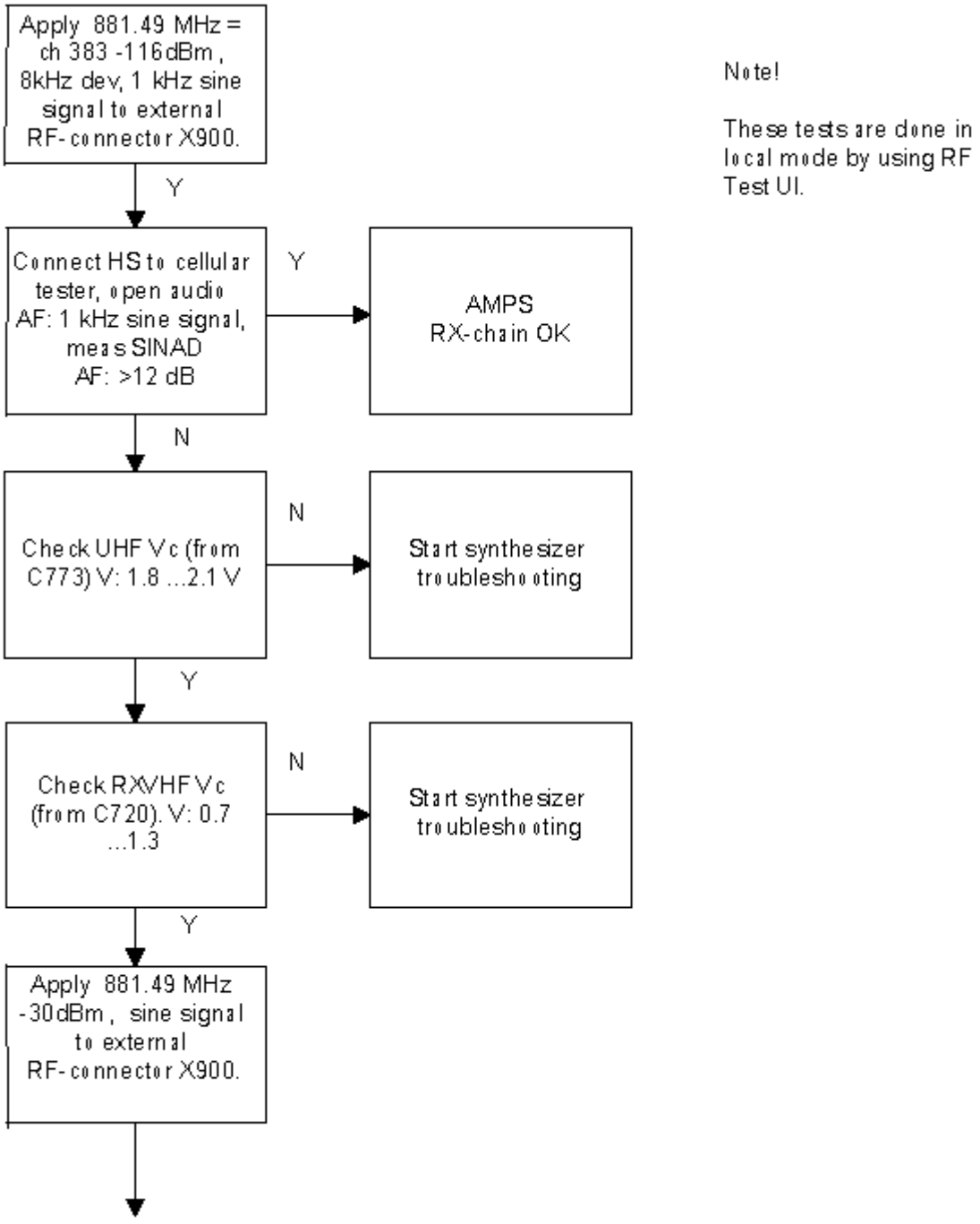
(Antenna/ext RF) – Diplexer – Duplexer – Low Noise Amplifier (LNA) – RX band filter – First mixer – 135.54 MHz RX IF filter – IF-amplifier – second mixer – 14 kHz low-pass filter – adjustable IQ amplifier – Baseband.

Fault-finding charts for receiver chain

AMPS

Figure 10: Fault tree, AMPS


Apply 881.49 MHz = ch 383 -116dBm, 8kHz dev, 1 kHz sine signal to external RF-connector X900.
Y
Connect HS to cellular tester, open audio AF: 1 kHz sine signal, meas SINAD AF: >12 dB
Y
AMPS RX-chain OK
N
Check UHF Vc (from C773) V: 1.8 ...2.1 V
N
Start synthesizer troubleshooting
Y
Check RX/VHF Vc (from C720). V: 0.7 ...1.3
N
Start synthesizer troubleshooting
Y
Apply 881.49 MHz -30dBm, sine signal to external RF-connector X900.
Note!
These tests are done in local mode by using RF Test UI.

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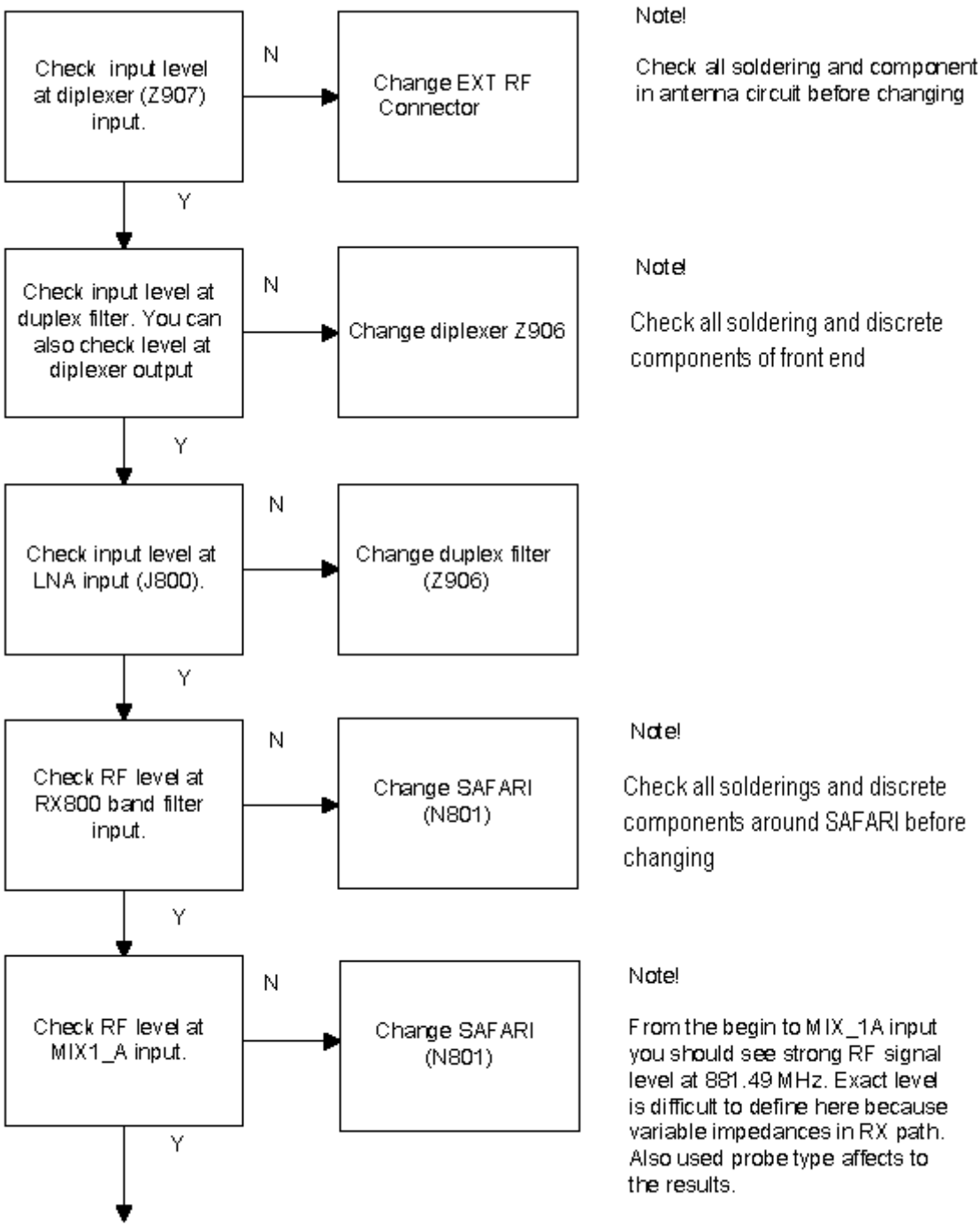
Check input level at diplexer (Z907) input.
N
Change EXT RF Connector
Y
Check input level at duplex filter. You can also check level at diplexer output
N
Change diplexer Z906
Y
Check input level at LNA input (J800).
N
Change duplex filter (Z906)
Y
Check RF level at RX800 band filter input.
N
Change SAFARI (N801)
Y
Check RF level at MIX1_A input.
N
Change SAFARI (N801)
Y
Note!
Check all soldering and components in anterna circuit before changing
Note!
Check all soldering and discrete components of front end
Note!
Check all solderings and discrete components around SAFARI before changing
Note!
From the begin to MIX_1A input you should see strong RF signal level at 881.49 MHz. Exact level is difficult to define here because variable impedances in RX path. Also used probe type affects to the results.

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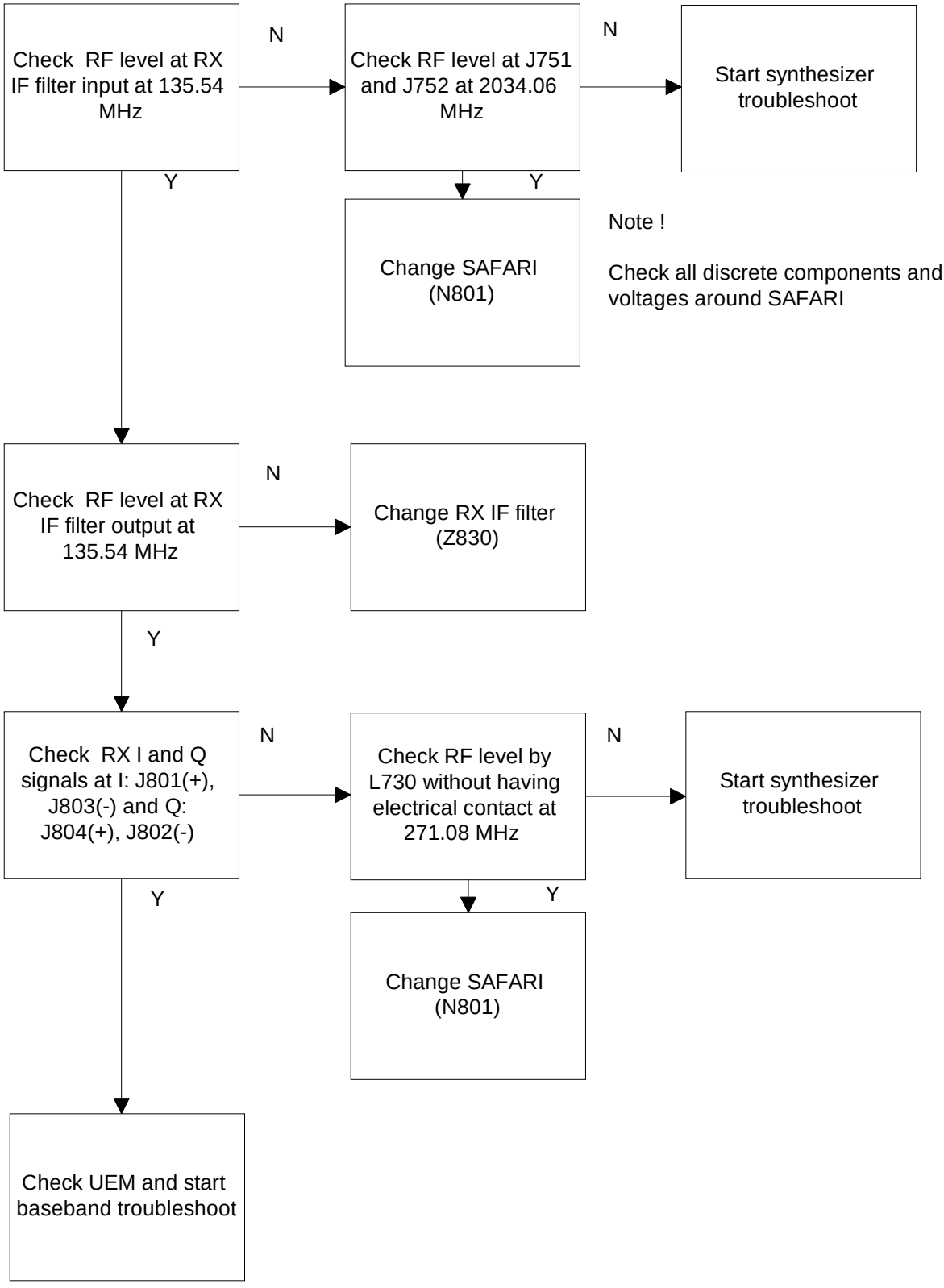
Check RF level at RX IF filter input at 135.54 MHz
N
Check RF level at J751 and J752 at 2034.06 MHz
N
Start synthesizer troubleshoot
Y
Y
Change SAFARI (N801)
Note !
Check all discrete components and voltages around SAFARI
Check RF level at RX IF filter output at 135.54 MHz
N
Change RX IF filter (Z830)
Y
Check RX I and Q signals at I: J801(+), J803(-) and Q: J804(+), J802(-)
N
Check RF level by L730 without having electrical contact at 271.08 MHz
N
Start synthesizer troubleshoot
Y
Y
Change SAFARI (N801)
Check UEM and start baseband troubleshoot

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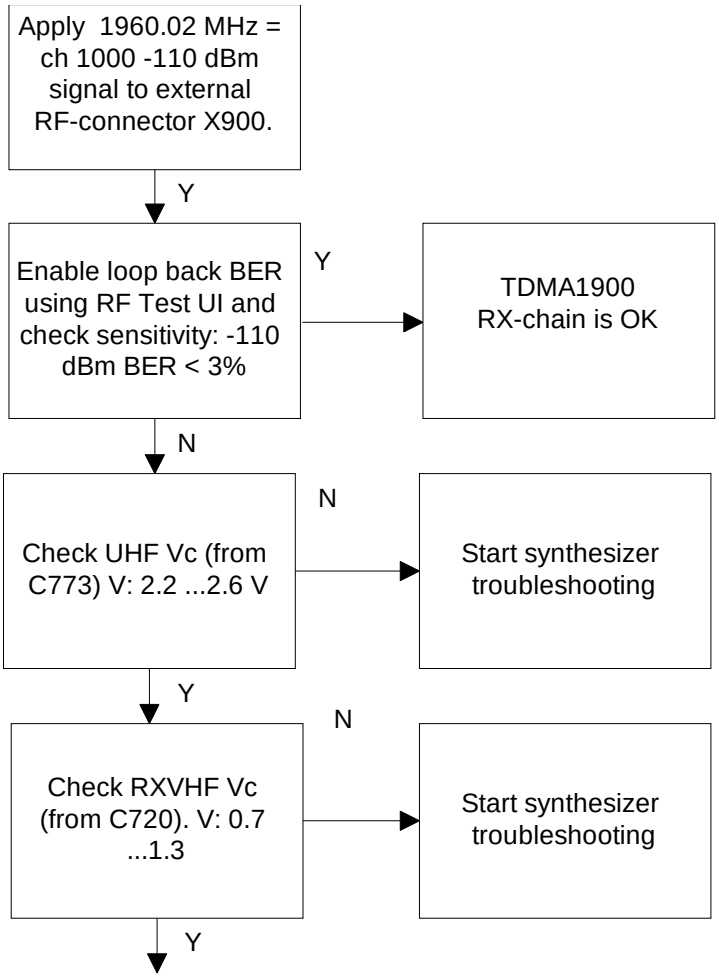
TDMA800

Since the same physical signal path is used for both analog and digital modes at the lower band, there is no need for additional troubleshooting in the digital mode. So if the digital mode at the lower band is not working properly, start the analog mode troubleshooting.

TDMA1900 (only dualband)

Only EXT RF connector –> 1st IF needs separate troubleshoot at upper band. After down conversion (RF –> 135.54 MHz), both lower and upper band use the same signal path.

Figure 11: Fault tree, TDMA1900 troubleshooting


Apply 1960.02 MHz = ch 1000 -110 dBm signal to external RF-connector X900.
Y
Enable loop back BER using RF Test UI and check sensitivity: -110 dBm BER < 3%
Y
TDMA1900 RX-chain is OK
N
Check UHF Vc (from C773) V: 2.2 ...2.6 V
N
Start synthesizer troubleshooting
Y
Check RXVHF Vc (from C720). V: 0.7 ...1.3
N
Start synthesizer troubleshooting
Y

Note!

These tests are done in local mode by using RF Test UI.

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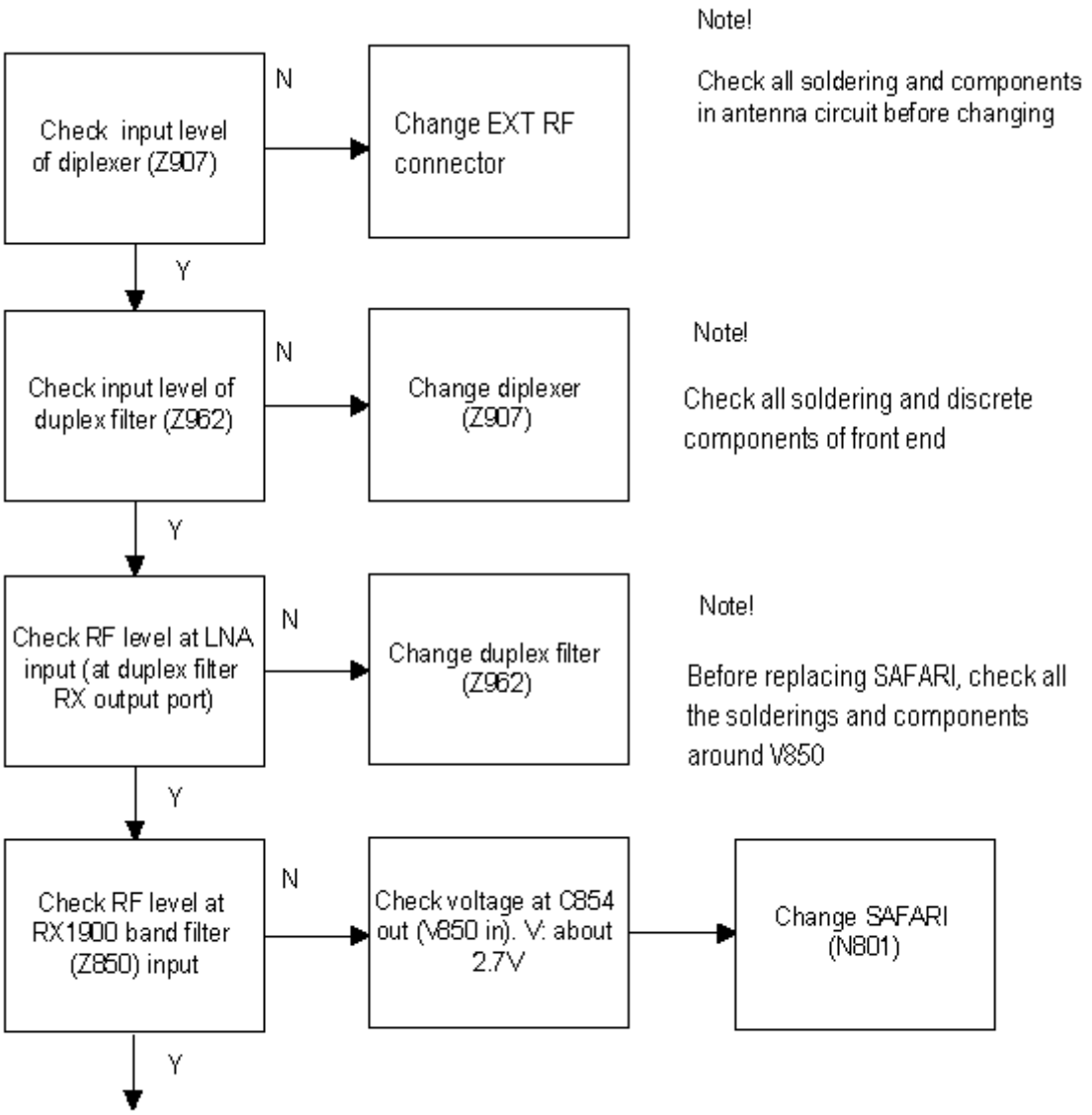
Check input level of diplexer (Z907)
N
Change EXT RF connector
Note!
Check all soldering and components in antenna circuit before changing
Y
Check input level of duplex filter (Z962)
N
Change diplexer (Z907)
Note!
Check all soldering and discrete components of front end
Y
Check RF level at LNA input (at duplex filter RX output port)
N
Change duplex filter (Z962)
Note!
Before replacing SAFARI, check all the solderings and components around V850
Y
Check RF level at RX1900 band filter (Z850) input
N
Check voltage at C854 out (V850 in). V: about 2.7V
Change SAFARI (N801)
Y

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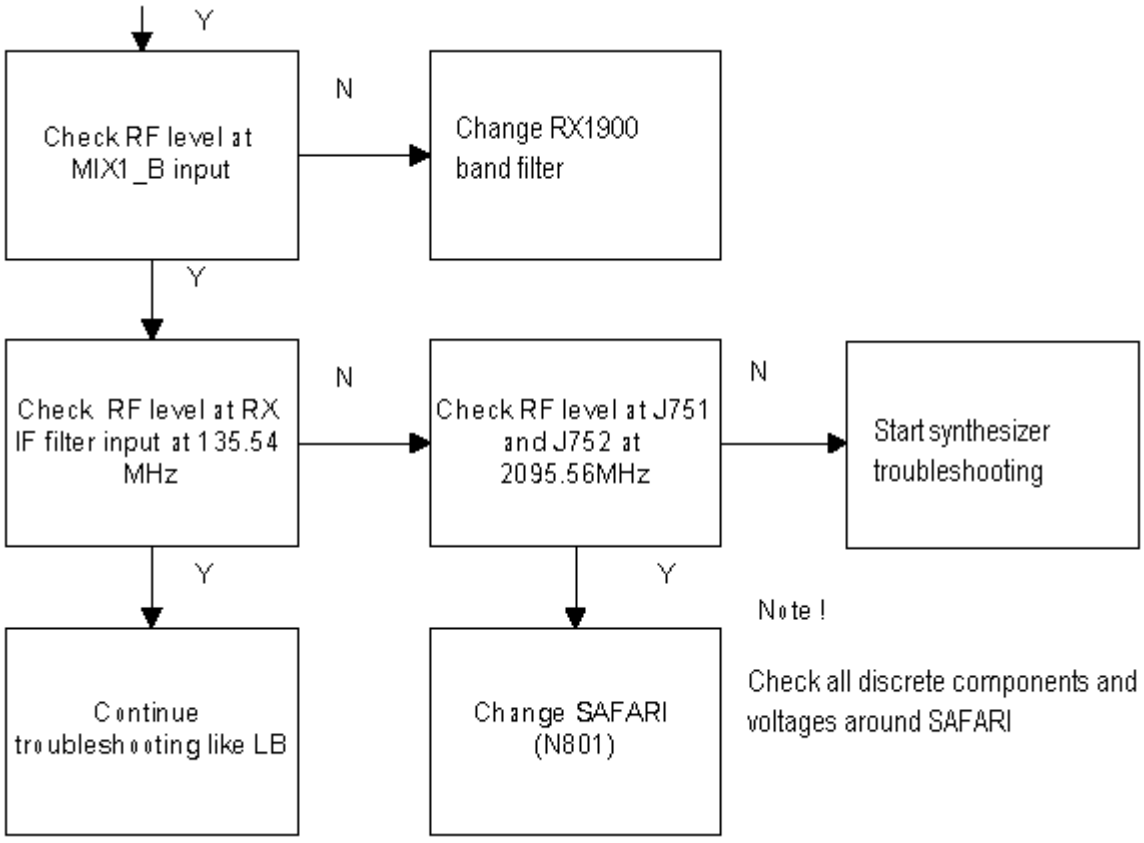

Table 2: Flash programming error codes

Error	Description	Not working properly
C101	"The Phone does not set FbusTx line high after the startup."	Vflash1 VBatt BSI and FbusRX from prommer to UEM. FbusTx from UPP->UEM->Prom-mer(SA0)
C102	"The Phone does not set FbusTx line low after the line has been high. The Prommer generates this error also when the Phone is not connected to the Prommer."	PURX(also to Safari) VR3 Rfclock(VCTCXO->Safari->UPP) Mbus from Prommer->UEM->UPP(MbusRx)(SA0) FbusTx from UPP->UEM->Prom-mer(SA1) BSI and FbusRX from prommer to UEM.

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C103	"Boot serial line fail."	Mbus from Prommer->UEM->UPP(MbusRx)(SA1) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
C104	"MCU ID message sending failed in the Phone."	FbusTx from UPP->UEM->Prommer
C105	"The Phone has not received Secondary boot codes length bytes correctly."	Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
C106	"The Phone has not received Secondary code bytes correctly."	Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer
C107	"The Phone MCU can not start Secondary code correctly."	UPP
C586	"The erasing status response from the Phone informs about fail."	Flash
C686	"The programming status response from the Phone informs about fail."	Flash
Cx81	"The Prommer has detected a checksum error in the message, which it has received from the Phone."	FbusTx from UPP->UEM->Prommer
Cx82	"The Prommer has detected a wrong ID byte in the message, which it has received from the Phone."	FbusTx from UPP->UEM->Prommer
A204 Cx83 Cx84 Cx85	"The flash manufacturer and device IDs in the existing Algorithm files do not match with the IDs received from the target phone." "The Prommer has not received Phone acknowledge to the message." "The Phone has generated NAK signal during data block transfer." "Data block handling timeout"	Flash UPP VIO/VANA? Signals between UPP-Flash Mbus from Prommer->UEM->UPP(MbusRx) FbusRx from Prommer->UEM->UPP FbusTx from UPP->UEM->Prommer

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Cx87	"Wrong MCU ID."	RFClock UPP(Vcore)
Start-up for flashing	Required startup for flashing	Vflash1 VBatt

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Transmitter fault-finding

General instructions for TX troubleshooting

Always use RF cable connected from external RF connector to analyzer via (rf-power) attenuator. This is important to protect analyzer against excessive rf-power and not to let leak unwanted rf-power to the cellular frequencies.

Start Phoenix software and select TX mode under testing (AMPS, DAMPS, or TDMA1900). Select mid channel (383 for AMPS/DAMPS or 1000 for TDMA1900) and power level 2. Select random data for digital mode of operation.

After any component change, tune the phone with Phoenix autotune SW.

Path of the transmitted signal

AMPS/DAMPS

UEM TX I/Q DA-converters -> I/Q modulator and Digital gain step amplifier (SafariSafari) -> IF-BPF -> Upconverter+driver -> BPF -> PA -> Coupler (Power detector) -> Duplex-filter -> Diplexer -> EXT RF-connector -> Antenna

TDMA1900 (ONLY DUALBANDER)

UEM TX I/Q DA-converters -> I/Q modulator and Digital gain step amplifier (Safari) -> IF-BPF -> Upconverter + driver (Safari) ->Balun -> BPF -> PA->Coupler (Power detector) -> Duplex-filter -> Diplexer -> EXT RF-connector -> Antenna

Power detection and power control circuit belongs under power control part of this guide.

Fault-finding charts for transmitter

AMPS

Start Phoenix software and set phone to the Analog mode. Set channel 383 and Power level 2. Connect RF cable to EXT RF connector and connect cable to Spectrum analyze input, and measure RF level. Notice insertion loss of the cable and attenuations.

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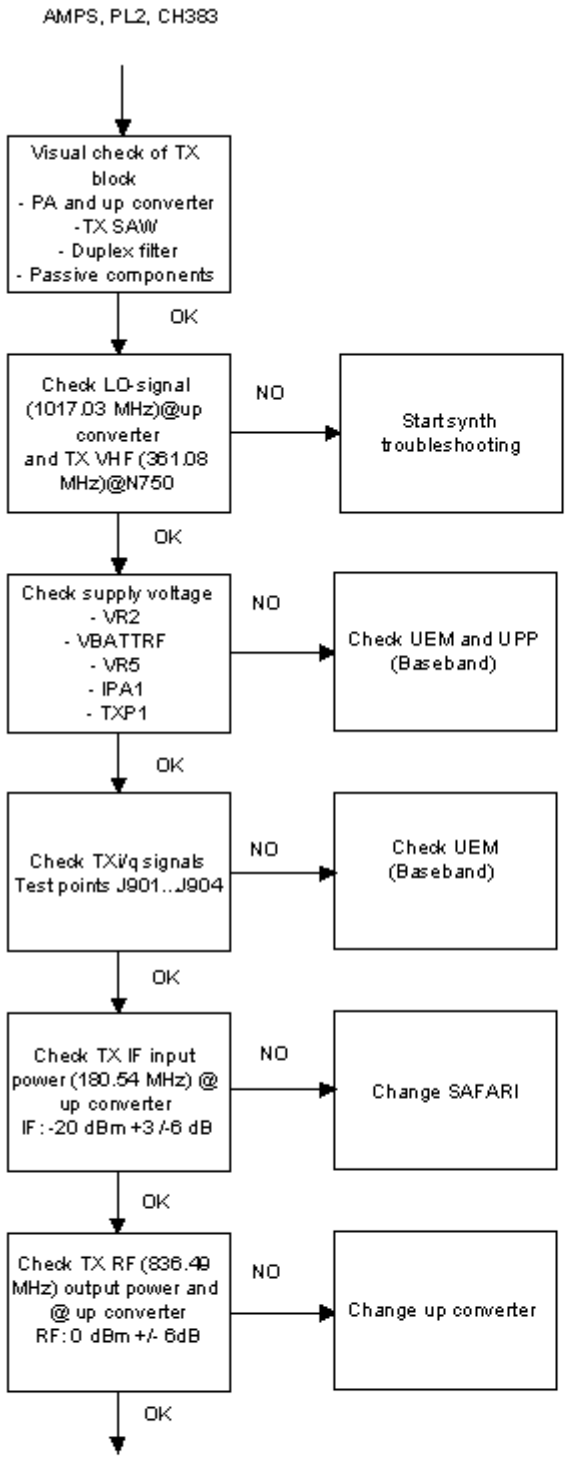

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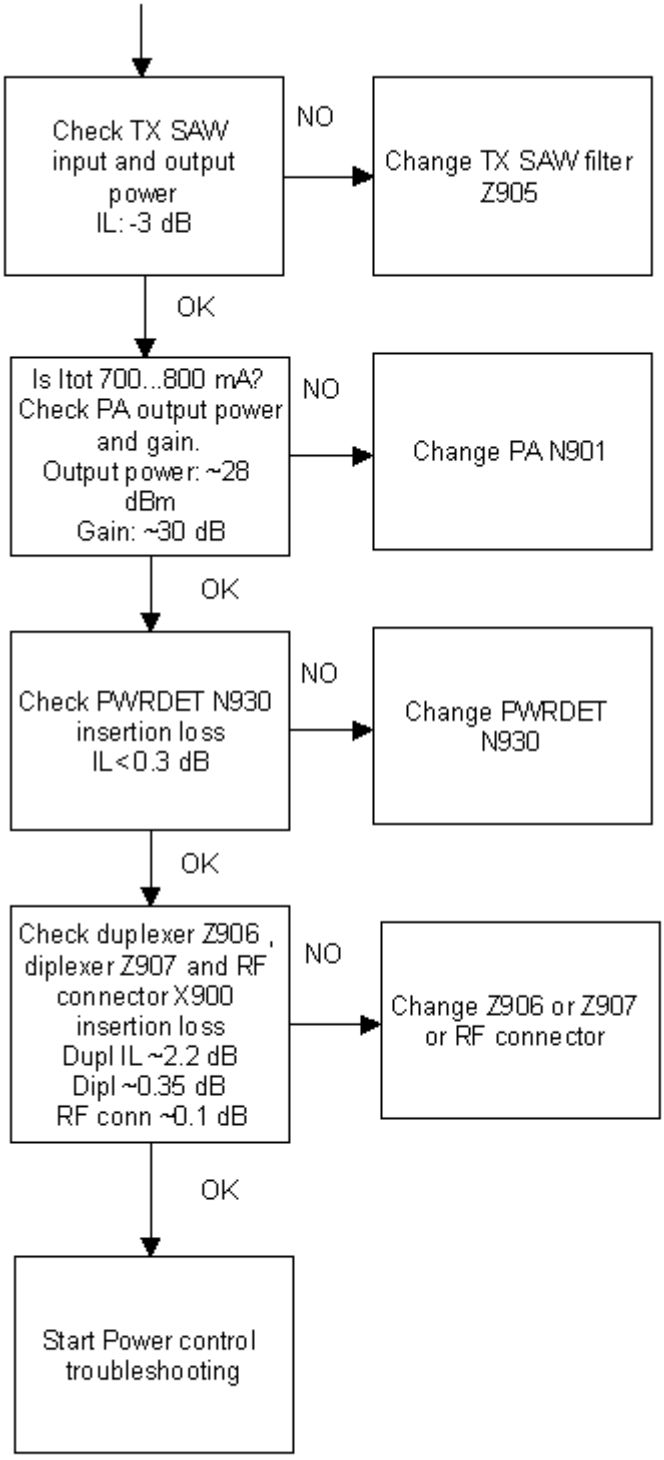
Check TX SAW input and output power IL: -3 dB
NO
Change TX SAW filter Z905
OK
Is Itot 700...800 mA? Check PA output power and gain. Output power: ~28 dBm Gain: ~30 dB
NO
Change PA N901
OK
Check PWRDET N930 insertion loss IL<0.3 dB
NO
Change PWRDET N930
OK
Check duplexer Z906 , diplexer Z907 and RF connector X900 insertion loss Dupl IL ~2.2 dB Dipl ~0.35 dB RF conn ~0.1 dB
NO
Change Z906 or Z907 or RF connector
OK
Start Power control troubleshooting

TDMA800

The transmitter chain is exactly the same as AMPS mode, with the exception of the IPA current. Therefore it is important that AMPS has no faults.

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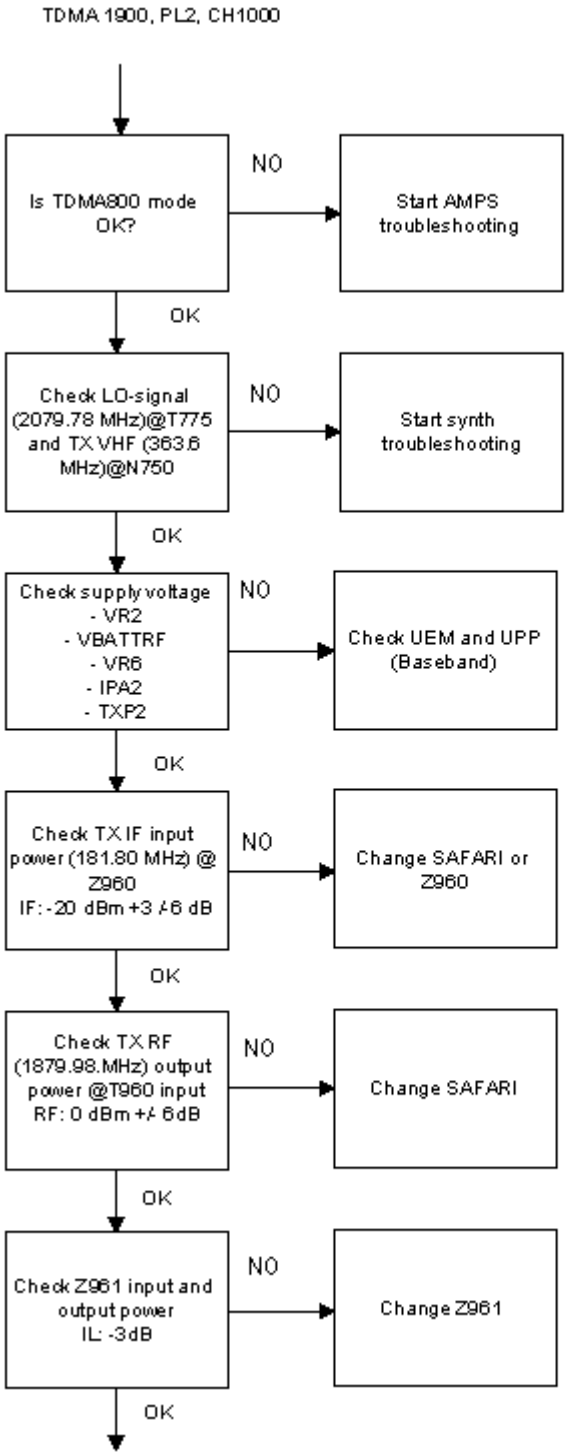
TDMA1900 (only dualbander)

TDMA1900 mode and DAMPS mode have a common RF modulator, making it important that the DAMPS mode has no faults.



Power control loop

Basically power detection is done with the Power detector module and power control is done inside Safari. Power detection is basically similar for both bands, except both bands have individual couplers.

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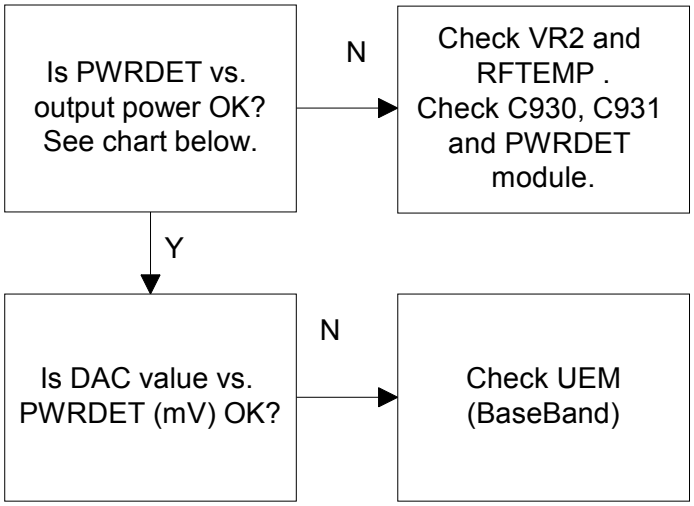
Is PWRDET vs. output power OK? See chart below.
N
Check VR2 and RFTEMP . Check C930, C931 and PWRDET module.
Y
Is DAC value vs. PWRDET (mV) OK?
N
Check UEM (BaseBand)

Note !

See PWRDET vs. Output power curve

Detected voltages are described in the next table and diagram.

TYPICAL DETECTED VOLTAGES AT POWER LEVELS PL2…PL10 FOR DUALBANDER

800A					800D				1900D		
	Pout	TXPWRDET			Pout	TXPWRDET			Pout	TXPWRDET	
PL	dBm	dac	mV		dBm	dac	mV		dBm	dac	mV
2	26.5	633	1671		27.3	696	1839		27.3	662	1746
3	22.5	393	1038		23.3	433	1142		23.3	405	1069
4	18.5	237	625		19.3	261	688		19.3	245	648
5	14.5	141	372		15.3	155	410		15.3	147	387
6	10.5	82	215		11.3	90	237		11.3	84	222
7	6.5	46	120		7.3	50	132		7.3	46	122
8	-	-	-		3.3	27	70		3.3	24	64
9	-	-	-		-0.7	13	33		-0.7	11	30
10	-	-	-		-4.7	5	12		-4.7	5	12

NOTE: DAC VALUES MAY VARY ABOUT +/- 20%
NOTE: TXPWRDET is difference between TX on burst and off burst.

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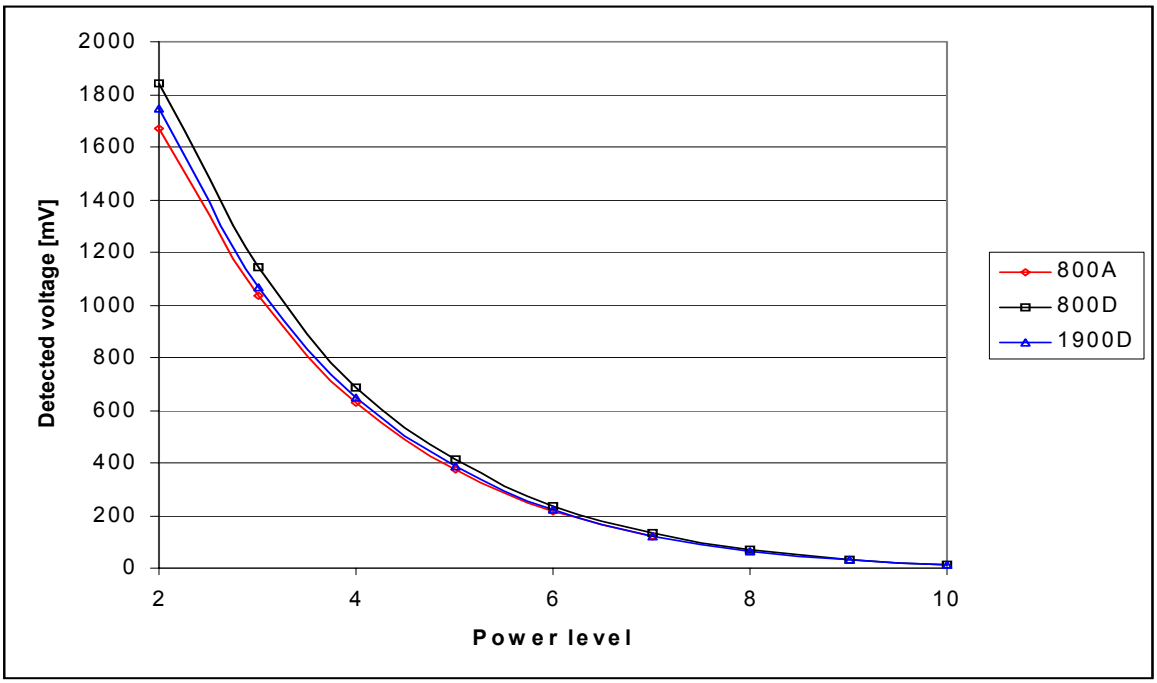

TYPICAL DETECTED VOLTAGES AT POWER LEVELS PL2..PL10 FOR SINGLE BANDER

800A					800D		
	Pout	TXPWRDET			Pout	TXPWRDET	
PL	dBm	dac	mV		dBm	dac	mV
2	25.5	559	1475		27.3	671	1771
3	21.5	388	1023		23.3	465	1228
4	17.5	234	618		19.3	281	742
5	13.5	140	371		15.3	168	445
6	9.5	81	215		11.3	98	258
7	5.5	45	120		7.3	54	144
8	-	-	-		3.3	31	82
9	-	-	-		-0.7	15	40
10	-	-	-		-4.7	5	14

NOTE: DAC VALUES MAY VARY ABOUT +/- 20%
NOTE: TXPWRDET is difference between TX on burst and off burst.

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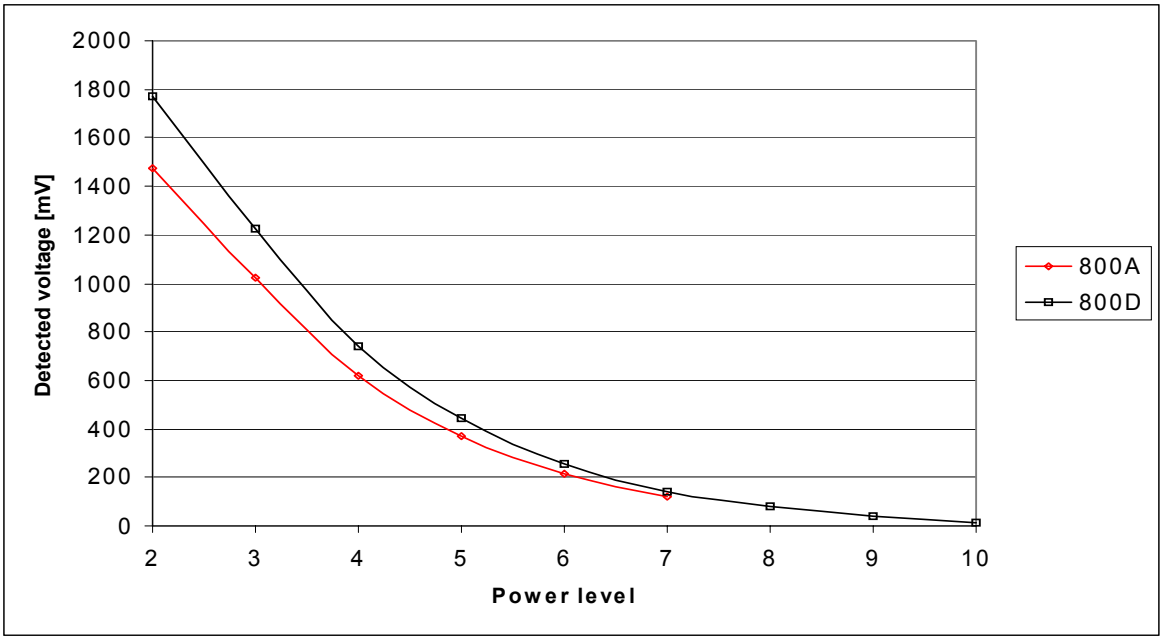

Synthesizer fault-finding

There are four oscillators generating the needed frequencies for the RF section: 19.44 MHz reference oscillator, 2GHz UHF VCO, TX VHF cascade amplifier VCO, and RX VHF VCO integrated in Safari. RX VHF frequency is fixed at 271.08 MHz and TX VHF has two fixed frequencies: 361.08 MHz for lowband and 363.6 MHz for upper band. The VCO operating frequencíes are controlled by the Safari PLL circuit. All locals are locked to stable 19.44MHz reference oscillator.

The frequency range for 2GHz UHF VCO is 2009.1 ... 2125.53 MHz. The output frequency range for the lower band is from 2009.1 to 2059.02 MHz. In upper band, the output frequency range from the UHF VCO is from 2031.81 MHz to 2125.53 MHz.

A practical way to check out the synthesizer status is to measure control voltage of the VCO from the Integrator capacitor. If voltage is stable and reasonable, local oscillators are running correctly.

19.44 MHz reference oscillator

The 19.44 MHz oscillator frequency (G790) is controlled by UEM. This 19.44 MHz signal is connected to Safari, PLL-circuits, and from Safari to UPP.

All synthesizers use divided VCTCXO signal as a reference signal for Phase-locked loop to provide correct LO-frequency.

Baseband also needs a reference signal where it can generate the necessary clock signals and VCTCXO output signal is also buffered and connected to UPP.

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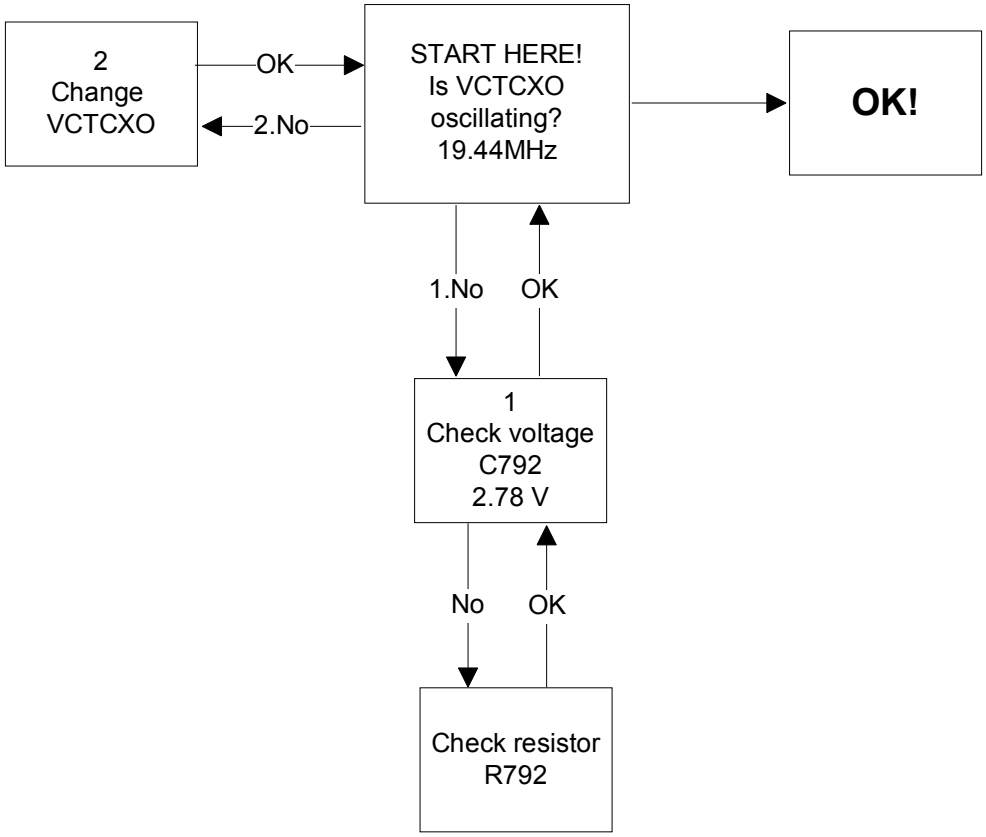
Fault-finding chart for 19.44 MHz oscillator



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RX VHF VCO

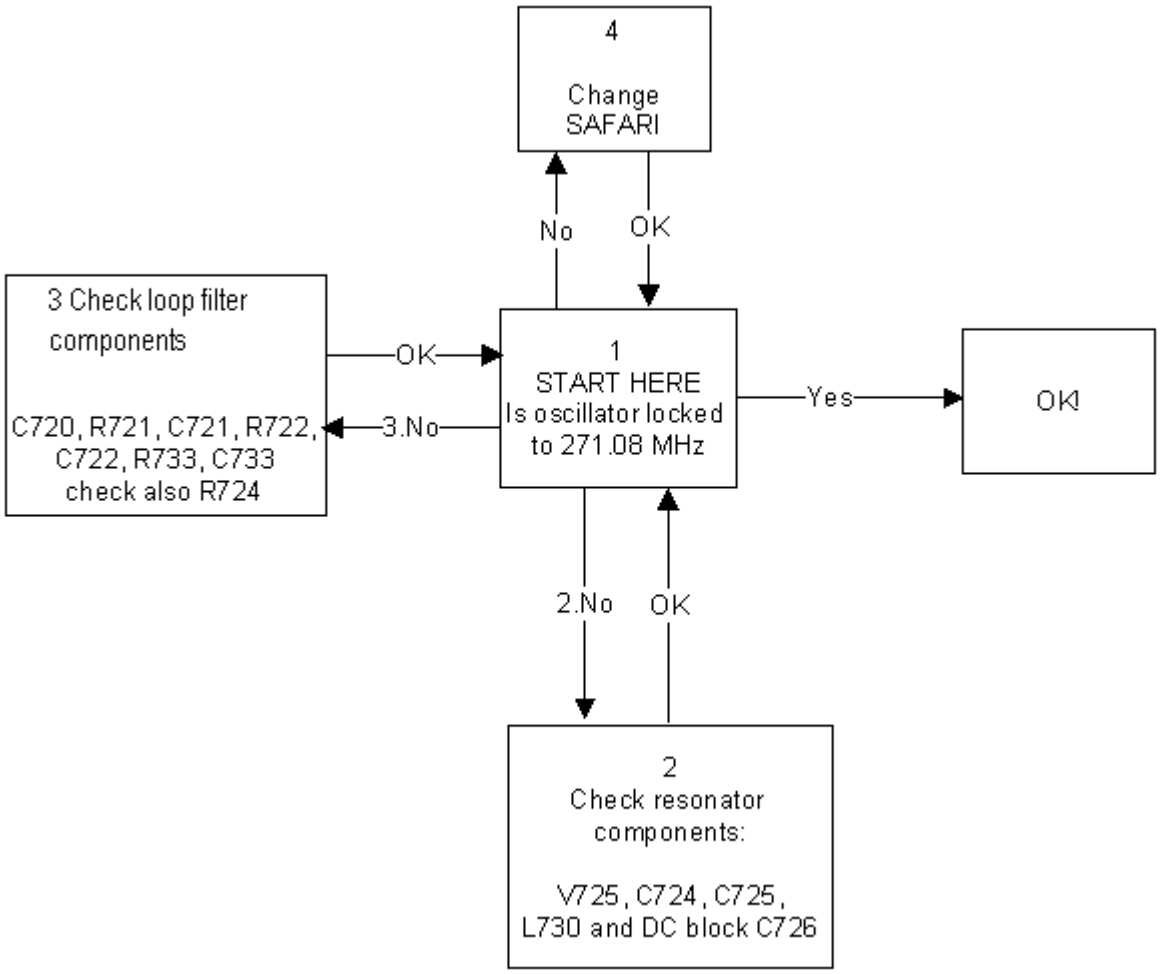
The RX VHF VCO signal is used to generate receiver Intermediate frequency. RX VHF VCO has one fixed frequency (271.08 MHz). Operating frequency is locked in Phase-locked loop.

RX VHF VCO output signal is fed to Safari. The inside of the Safari signal is divided into the Phase detector and RX parts. Before I/Q modulator frequency is divided by 2.

Fault-finding chart for RX VHF VCO

Measure oscillator frequency over L730 coil. Don´t connect probe to pads!

AMPS, CH383



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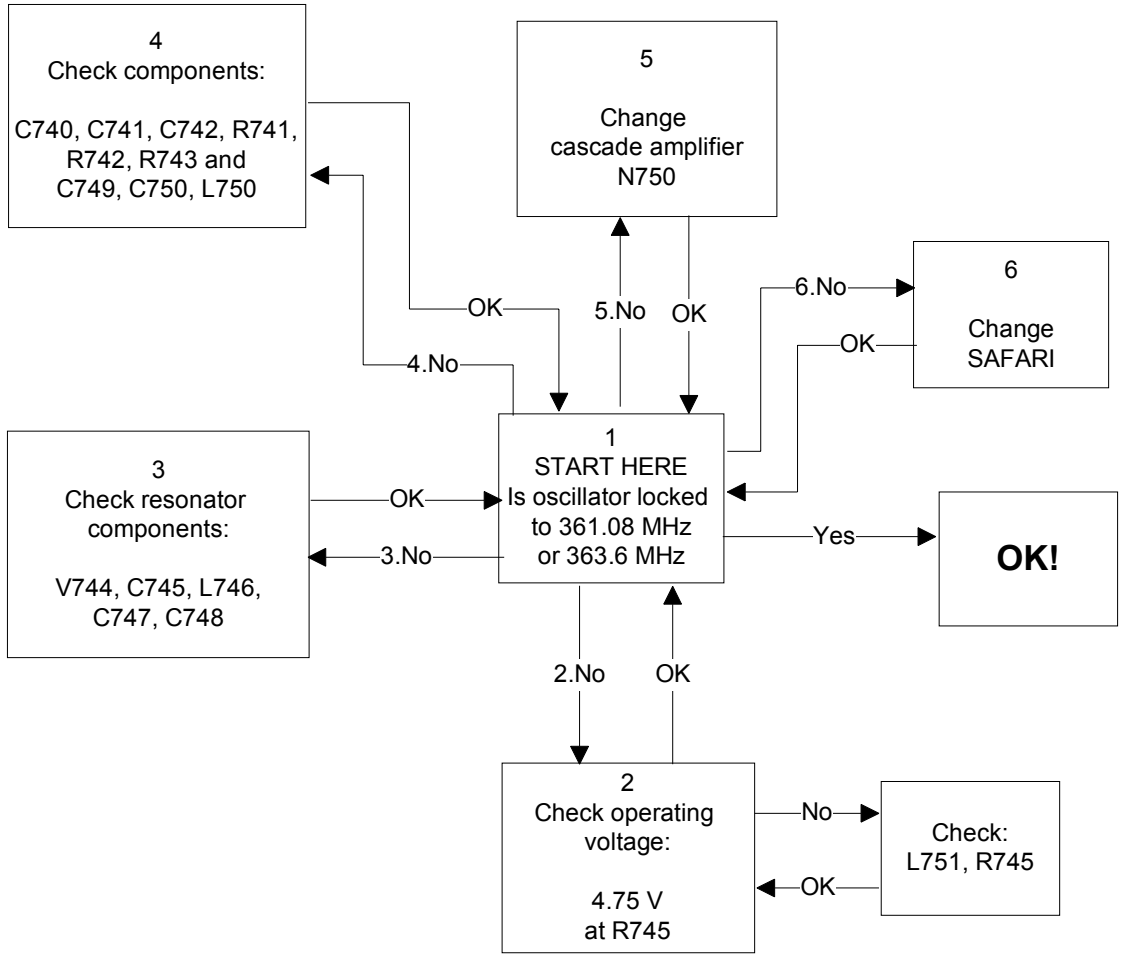
TX VHF VCO

The TX VHF VCO signal is used to generate transmitter Intermediate frequency. TX VHF VCO has two fixed frequencies (361.08 MHz for lower band and 363.6 MHz for upper band). Operating frequency is locked in Phase-locked loop and frequency is divided by two before modulator.

Fault-finding chart for TX VHF VCO

AMPS, CH383 -> TX VHF frequency 361.08 MHz

TDMA1900, CH1000 -> TX VHF frequency 363.6 MHz



UHF Synthesizer

The UHF Synthesizer consists of an external 2GHz UHF VCO, loop filter and an integrated PLL in the Safari RF IC. Safari T IC contains stages like counters, prescaler, divider by two, phase and frequency comparator, and a charge pump circuit which allows two operational modes—analog and digital. The UHF VCO Oscillation frequency is from 2009.1MHz to 2125.53 MHz.

In the upper band (TDMA1900), 2 GHz synthesizer frequency is fed straight to mixers. In the lower band (AMPS and TDMA800), 2 GHZ UHF VCO frequency signal is first divided by two inside Safari and then that divided signal is fed to mixers. The output frequency

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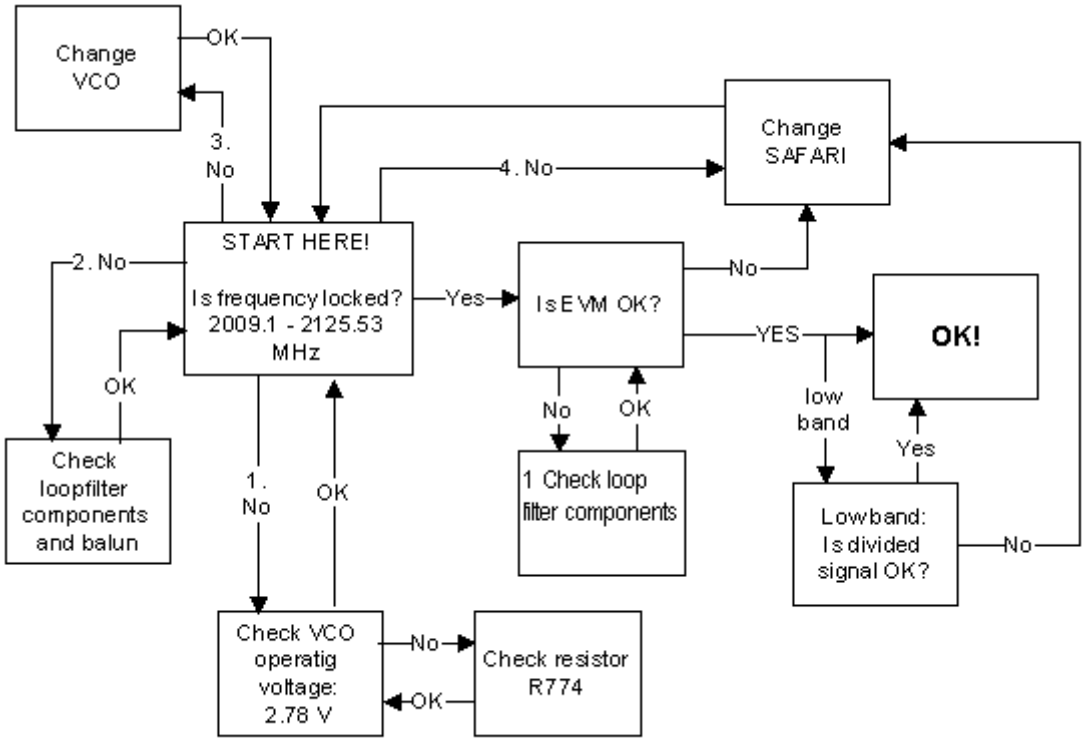
of the VCO depends on the DC control voltage, which is controlled by the PLL circuit inside Safari.

Fault-finding chart for UHF Synthesizer



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